UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C., 20460

OFFICE OF
CHEMICAL SAFETY AND
POLLUTION PREVENTION

PC Code: 024875
DP Barcode: 437794
Date: July 27, 2017

MEMORANDUM

SUBJECT: Assessment of the Proposed Increase in the Number of Potential Crop Seasons for Specified Uses of Spiromesifen

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The Environmental Fate and Effects Division (EFED) has completed its evaluation of the proposed increase in the number of potential crop seasons for the insecticide/miticide spiromesifen (PC Code 024875; CAS No 283594-90-1) on cotton, cucurbits, leafy and fruiting vegetables, strawberries, and tuberous and corm vegetables. Specifically, the technical registrant

(Bayer CropScience LP) is proposing clarifying information on the number of crop cycles allowed for crops on the Oberon® Speed label (EPA Reg. No. 264-RRIT). The annual use rates that would result from the increase in the number of potential crop seasons are similar to the range of use rates in the 2010 Section 3 New Use assessment completed for wheat, sorghum, dry peas, mint, and leafy petioles crop subgroup (4b) (USEPA 2010a). Given this similarity in use rates, the previous recommended EDWCs for human health dietary assessment as well as previous ecological risk assessment may be relied upon to characterize risk for the proposed application rates in this Section 3 New Use assessment. The proposed use rates resulting from the increase in potential crop seasons, along with the rates evaluated, are summarized in **Appendix A**.

New data have been submitted by Bayer since the 2010 assessment; however, with the exception of a single study (MRID 480335-01), these new data have not been reviewed and are not taken into account in this action (see below for additional details). Additionally, EFED acknowledges the receipt of the registrant's "*Aquatic Ecological Exposure and Drinking Water Assessment*" for spiromesifen, but has not considered the document in the context of this action.

Ecological Risk Summary

Previous risk assessments (USEPA 2010a; USEPA 2015a) indicated chronic risk to listed and non-listed mammals and birds; acute and chronic risk for listed freshwater fish; chronic risk to non-listed freshwater fish; and, risk to listed estuarine/marine invertebrates based on acute exposure. Since freshwater fish serve as surrogates for aquatic-phase amphibians and since birds serve as surrogates for terrestrial-phase amphibians and reptiles, acute and chronic risk estimates extend to these other taxa as well.

Also, previous assessments concluded that spiromesifen was practically non-toxic to adult honeybees (*Apis mellifera*) on an acute exposure basis, but that there was the potential for risk to larval honeybees and therefore to colony development from environmental exposures to spiromesifen. Specifically, a semi-field study (MRID 480335-01) with formulated spiromesifen (Spiromesifen SC240, 24% a.i.) found that exposure significantly ($p<0.05$) reduced larval bee (brood) survival.

There are new ecological effects studies that were submitted by the registrant in response to the 2015 Problem Formulation and Generic Data Call-in (GDCI) for spiromesifen (USEPA 2015), but for the most part these studies have not been reviewed and so are not considered in the context of this action. The single exception is a micro-colony toxicity study (MRID 497173-02) with the bumble bee (*Bombus terrestris*), which found that young adult female and larval male bees in micro-colonies exposed to nominal dietary spiromesifen residues of 0.06% were not adversely affected; this study is classified as supplemental though since it did not verify exposure levels.

Table 1 summarizes potential environmental fate concerns. Risk estimates for non-listed species are summarized in **Table 2**; see the following Registration Review risk assessments for additional characterization of the potential for ecological risk from spiromesifen:

- *Spiromesifen New Use Risk Assessment for Proposed Uses on Wheat, Sorghum, Dry Peas, Mint, and the Leafy Petioles Crop Subgroup (4B) (USEPA 2010a)*

- *Registration Review: Draft Problem Formulation for Environmental Fate, Ecological Risk, Endangered Species, and Human Health Drinking Water Exposure Assessments for Spiromesifen (USEPA 2015)*

Table 1. Potential environmental fate concerns identified in previous assessments for spiromesifen.

Bioconcentration/ Bioaccumulation[1]	Groundwater Contamination[2]	Sediment[1]	Persistence	Volatilization	Residues of Concern
No	No[2]	Yes	No[3]	No	*DWA:* Parent, BSN2060-enol & BSN2060-carboxy *ERA:* Parent

DWA: Drinking Water Assessment
ERA: Ecological Risk Assessment
1. Bio-concentration was not previously identified as a risk concern, but due to the limited soil mobility of spiromesifen erosion of sediment-bound residues was identified as an important means of off-field transport.
2. Previous risk assessments indicated that spiromesifen (parent) has limited soil mobility and moderate bio-degradation half-lives and so is not a groundwater concern; however, the degradates BSN2060-enol and BSN2060-carboxy are highly mobile and generally slightly more persistent, therefore these degradates may reach groundwater and surface water bodies more readily than the parent.
3. Aerobic soil metabolism half-lives for parent spiromesifen were 12 to 49 days, while half-lives for total residues range from 7 to 90 days. Aerobic aquatic metabolism half-lives for parent spiromesifen range from 12 to 18 days, while half-lives for total residues range from 45 to 60 days.

Table 2. Potential for direct effects to non-listed species identified in previous assessments for spiromesifen[1].

	Birds[2]	Mammals[3]	Terrestrial Inverts.[4]	Aquatic Verts.[5]	Aquatic Inverts.[5]	Terrestrial Plants	Aquatic Plants
Acute	NO *(see [2])*	NO – RQs: ≤0.04	*Uncertain (see [4])*	NO - RQs: 0.05-0.09 (FW); <0.02-<0.03 (E/M)	NO - RQs: <0.01-<0.02 (FW); <0.03-<0.06 (E/M)	NO – RQs: <0.1	NO – RQs: <0.02->0.15
Chronic	YES – RQs: **0.06-1.5**	YES – RQs: **0.09-22.2**		YES - RQs: **0.41-2.00 (FW)**; ND (E/M)	YES - RQs: **0.96-4.00 (FW)**; 0.02-0.09 (E/M)		

BOLD: Indicates that RQs exceed the LOC for risk to non-listed species based on the 2010 Environmental Risk Assessment (USEPA 2010a).
E/M: Estuarine/marine aquatic species.
FW: Freshwater aquatic species.
ND: No available data.
1. Risk concerns were identified when the risk quotient (RQ) exceeded the corresponding level of concern (LOC) for non-listed species only in a previous risk assessment (USEPA 2010a). Risk concerns were based on assorted crop scenarios from the 2010 Section 3 New Use Ecological Risk Assessment (ERA; USEPA 2010a), with relevant details on the specific crop scenarios given in **Appendix A**.
2. Because there was no mortality or sublethal effects at the highest treatment levels tested in submitted studies, the likelihood of acute mortality was qualitatively determined to be low (*i.e.*, RQs for acute risk were not estimated). Birds serve as surrogates for terrestrial-phase amphibians and reptiles; the chronic risk LOC was exceeded for some – but not all – use and dietary exposure scenarios (see USEPA 2010a).
3. The mammalian chronic risk LOC was exceeded for some – but not all – use and dietary exposure scenarios (see USEPA 2010a).
4. At the time of the last ERA, the risk conclusion was that spiromesifen was not likely to result in direct adverse effects on honeybees (and by extension terrestrial invertebrates for which they serve as surrogates), but based on the results of several colony-level field studies there is exposure from the transfer of spiromesifen residues back to bee colonies by foraging adults, and these residues resulted in increased mortality of honeybee larvae.
5. Fish serve as surrogates for aquatic-phase amphibians. For non-listed freshwater vertebrates and invertebrates only the chronic risk LOC was exceeded, and LOC exceedances for freshwater vertebrates and invertebrates were similar across all crop scenarios modeled in the 2010 ERA (see USEPA 2010a).

Estimated Environmental Concentration Summary

The use rates for spiromesifen resulting from the proposed change in potential crop seasons are listed in **Appendix A**. Estimated environmental concentrations (EEC) of spiromesifen for ecological risk assessment were calculated for the proposed increase in crop seasons based on

parent compound alone, as none of the major degradates were shown to have equal or greater toxicity. Specifically, Bayer proposes increasing the number of crop cycles from one to three in conjunction with a reduced application rate, which results in a higher annual maximum application rate than previously assessed for cucurbits, fruiting vegetables, and leafy green vegetables crop groups. However, the annual maximum application rate resulting from the proposed increase to three crop seasons per year is lower than the new uses assessed in 2010 for leafy petioles; therefore, the results from the previous risk assessment can be relied upon to characterize the risks from the proposed new uses. Details for the modeling and input parameters are found in **Appendix C**.

For the proposed increase in crop seasons, the maximum EEC is 1.21 µg/L for the 1-in-10-year peak based on the melon scenario; for the 21- and 60-day average concentrations the maximum EECs were 0.14 and 0.08 µg/L, respectively, both based on the lettuce scenario (**Table 3**). These concentrations are based on an application rate of 0.127 pounds' active ingredient per acre (lbs a.i./A) applied three times per crop cycle at a 7-day retreatment interval with three crop cycles per year for a total of 1.14 lbs a.i./A/year. The maximum EEC derived in the previous ecological risk assessment (USEPA 2010a) was 1.5 µg/L for sorghum was based on up to two applications per year with a maximum single application rate of 0.25 lbs a.i./A and a maximum annual application rate of 0.27 lbs a.i./A/year.[1]

Table 3. Estimated Maximum Proposed New Use EEC for Spiromesifen (µg/L)[1]

Scenario	1-in-10 Year Peak Concentration (Acute)	21 Day Average Concentration	60 Day Average Concentration
STXmelonNMC	**1.21**	0.135	0.078
CAlettuceSTD	0.92	**0.137**	**0.083**

[1] **Bolded** value are the highest EEC across all uses.

Drinking Water Summary

The residues of concern for human health in drinking water include the parent compound and the degradates BSN2060-enol and BSN2060-carboxy, which are highly mobile and more persistent than the parent compound (USEPA 2006). The previous assessment (USEPA 2010a) derived estimated drinking water concentration (EDWC) of spiromesifen using a total residues of concern approach, and this new use assessment utilizes the same approach. The EDWCs for surface and groundwater are based on simulations of areas vulnerable to runoff and leaching, respectively. These estimates may be refined in the future if they are determined to exceed drinking water LOCs. Details on the modeling and input parameters are found in **Appendix C**. A Percent Cropped Area (PCA) adjustment factor of 1.0 was assumed for the surface water EDWC as spiromesifen has multiple uses on crops that lack a crop-specific PCA (USEPA 2014a).

For the proposed increase in crop seasons, the maximum surface water EDWC is 73.7 µg/L for the 1-in-10-year peak, 61.3 µg/L for the 1-in-10-year annual mean concentration, and 47.7 µg/L

[1] Previous modeling of application to sorghum consisted of one application of 0.25 lb a.i./A and one application of 0.02 lb a.i./A.

for the 30-year average concentration (**Table 4**). The maximum groundwater EDWC is 50.5 µg/L, with a breakthrough time of 8,814 days, a post-breakthrough average of 43.6 µg/L and a simulation average of 18.8 µg/L. These concentrations are based on application rates of 0.13 lbs a.i./A applied three times per crop cycle, at a 7-day retreatment interval for three crop cycles per year for a total of 1.14 lbs a.i./A/year.

Table 4. Maximum EDWCs for Spiromesifen and Total Residues of Concern[2] (µg/L)[1]

	Scenario	Peak Concentration (Acute)	Annual Mean Concentration (Chronic)	Average Concentration (Cancer)
Submitted New Uses				
Surface Water	CAnurserySTD_V2	73.7	61.3	47.7
Groundwater	WI_corn_ForQA	50.5	43.6	18.8
Previously Assessed Uses				
Surface Water	Provisional Cranberry	**199**	**188**	**<188**
Groundwater	WI_corn_ForQA	**134**	**116**	**38.7**

[1] **Bolded** value are the highest EDWC across all uses.
[2] Residues of concern include spiromesifen, BSN2060-enol and BSN2060-carboxy, and unextracted residues.

Surface water EDWCs for previously assessed uses were 199 µg/L and 188 µg/L for the acute and annual average concentrations, respectively. These were estimated for direct application to water based on use on cranberries and were derived using the provisional cranberry model and a rate of 0.75 lbs a.i./A/year application rate with a 7-day retreatment interval and a PCA of 0.77. Groundwater EDWCs for previously assessed uses were 134 µg/L for the peak and 116 µg/L annual average 1-in-10-year exposure values. These were estimated for use on ornamentals based on application rates of 0.25 lb a.i./A applied three times per crop cycle for four crop cycles per year for a total of 3.0 lbs a.i./A/year.

No new monitoring data for spiromesifen have been identified by EFED since the previous assessment.(USDA, 2013; USGS, 2010) For additional discussion of the uncertainties, see the previous assessments (USEPA 2010a; USEPA 2015a).

REFERENCES

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USEPA. 2010b. *Guidance on Development and Use of the Index Reservoir in Drinking Water Exposure Assessments*. September 14, 2010.

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USEPA. 2014a. *Development of Community Water System Drinking Water Intake Percent Cropped Area Adjustment Factors for use in Drinking Water Exposure Assessments: 2014 Update*. September 9, 2014.

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USEPA. 2015c. *Standard Operating Procedure for Using the NAFTA Guidance to Calculate Representative Half-life Values and Characterizing Pesticide Degradation*. Version 2. March 23, 2015.

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Appendix A. Summary of Proposed and Previously Evaluated Use Patterns

The proposed increase in crop seasons and resulting application rates are summarized in **Table A1** along with a summary of uses that were reviewed in the registration review risk assessment. Unless otherwise specified, application rates in this document are presented in terms of lbs a.i./A.

Table A1. Spiromesifen Application Rates

Crop	Max Single Application Rate (lbs a.i./A)	Max Number of Apps/Cycle	Max Crop Cycles	Max Annual App. Rate (lbs a.i./A)	RTI (days)	App Method
Proposed New Use Rates						
Cucurbits Crop Group 8	0.127	3*	3[2]	1.14	7	Aerial/Ground
Fruiting Vegetables Crop Group 9	0.127	3*	3[2]	1.14	7	Aerial/Ground
Leafy Greens Subgroup 4A	0.127	3*	3[2]	1.14	7	Aerial/Ground
Cotton[1]	0.239	3	1	0.478	21	Aerial/Ground
Strawberries[1]	0.239	3	1	0.716	7	Ground
Tuberous and Corm Vegetables[1]	0.239	2	1	0.478	14	Aerial/Ground
Maximum Use Patterns Previously Evaluated						
Wheat, sorghum	0.25	1-2	1	0.27	7	Aerial/Ground
Cotton	0.25	2	1	0.50	7	Aerial/Ground
Strawberries	0.25	3	1	0.75	7	Ground
Cucurbit	0.133	3	1	0.399	7	Aerial/Ground
Fruiting Vegetables	0.133	3	1	0.399	7	Aerial/Ground
Tuberous and Corm Vegetables	0.25	2	1	0.50	7	Aerial/Ground
Field Corn	0.133	2	1	0.266	14	Aerial/Ground
Leafy Petioles	0.13	3	3[2]	1.2	7	Aerial/Ground
Dry Peas	0.19	3	1	0.57	7	Aerial/Ground
Beans	0.19	3	1	0.57	7	Aerial/Ground
Mint	0.25	3	1	0.75	7	Aerial/Ground
Ornamentals	0.25	3	4[3]	3.0	Not Specified[4]	Ground
Cranberries	0.25	3	1	0.75	7	Ground

RTI=minimum retreatment interval

* Calculated based on the single and crop cycle rate specified on the label.

[1] Label clarified that the rate allowed was an annual rate and there were not multiple crop cycles per year for the crop.

[2] Three applications occur per crop season at 7-day intervals beginning post-emergence, with three crop seasons per year at 120 day intervals.

[3] Three applications occur per crop season at 7-day intervals beginning post-emergence, with four crop seasons per year at 90 day intervals.

[4] Assumed 7 day RTI in the lack of label directions.

Appendix B. Ecological and Drinking Water Exposure Modeling

Estimation of water concentrations of spiromesifen and the residues of concern in surface water and groundwater was determined using the Pesticide Water Calculator (PWC v1.52) consisting of a graphical user interface shell integrating PRZM v.5.02 and VVWM v.1.02.2. Estimated drinking water concentrations were generated using EFED's suite of scenarios. Chemical property input values were chosen in accordance with the current input parameter guidance (USEPA, 2009) for the PWC model that are listed in **Appendix C**. Sample outputs of PWC are provided in **Appendix D**.

Surface Water

Use patterns that had previously generated the highest EECs or EDWCs for surface water were again simulated, along with the proposed new use rates, to determine the recommended EDWCs for human health (USEPA 2010a; USEPA 2015a). For surface water, simulations are run for multiple (usually 30) years and the EDWCs represent concentrations with a one-in-ten year return frequency, based on the thirty years of daily concentrations generated during each simulation. The default PCA of 1.0 was used according to the guidance titled "*Development and Use of Community Water System Drinking Water Intake Percent Cropped Area Adjustment Factors for use in Drinking Water Exposure Assessments: 2014 Update* (USPA, 2014a). Estimated residue of concern concentration in surface water used for environmental risk and drinking water are summarized in **Tables B1 and B2**, respectively. The highest value for each use are reported. Aerial application gave higher EDWC and EEC values for all cases except strawberries, as strawberries are not registered for aerial application. The highest values are highlighted in bold. Input parameters not summarized in **Table A1** are described in **Appendix C**.

Table B1. Estimated Environmental Concentrations (EEC) in µg/L Based on Selected Pesticide in Water Calculator (PWC) Scenarios for Surface Water[1]

Use	Scenario	1-in-10-year Peak Exposure (µg/L)	1-in-10-year 21-Day Concentration (µg/L)	1-in-10-year 60-Day Concentration (µg/L)
Submitted New Uses				
Cucurbits Crop Group 8	STXmelonNMC	1.21	0.135	0.078
Fruiting Vegetables Crop Group 9	FLtomatoSTD_V2	0.94	0.121	0.067
Leafy Greens Subgroup 4A	CAlettuceSTD	0.92	0.137	0.083
Previously Assessed Uses				
Sorghum	KSsorghumSTD	**1.5**	0.37	0.30
Leafy Petioles	CAlettuceSTD	1.1	**0.59**	**0.55**

[1] **Bolded** value are the highest EEC across all uses.

Table B2. Estimated Drinking Water Concentrations (EDWCs) in µg/L Based on Selected Pesticide in Water Calculator (PWC) Scenarios for Surface Water[1]

Use	Scenario	1-in-10-year Peak Exposure (µg/L)	1-in-10-year Annual Mean Exposure (µg/L)	30-year Mean Exposure (µg/L)
Submitted New Uses				
Cucurbits Crop Group 8	FLcucumberSTD	34.6	10.5	7.21
Fruiting Vegetables Crop Group 9	CARowCropRLF_V2	30.6	21.5	16.7
Leafy Greens Subgroup 4A	CAlettuceSTD	47.9	31.8	25.6
Previously Assessed Uses				
Cranberries	Provisional Cranberry Model	**199**	**188**	**<188**
Ornamentals	CAnurserySTD_V2	75.1	62.2	47.7

[1] **Bolded** value are the highest EDWC across all uses.

Groundwater

Tier 1 groundwater EDWCs were estimated using the groundwater module of PWC (*i.e.,* PWC-GW). The EDWCs for the submitted new uses were derived using the highest annual application rate of 0.127 lbs a.i./A, applied three times per crop cycle with a 7-day retreatment interval, with three crop cycles per year. The PWC-GW model is a one-dimensional leaching model used to estimate concentrations of pesticides in vulnerable groundwater located beneath an agricultural field. The model accounts for pesticide fate in the crop root zone and deeper soil zones, by simulating pesticide sorption and degradation as transport through the soil profile occurs after a pesticide is applied to an agricultural field. PWC-GW permits the assessment of multiple years of repeated pesticide application (up to 100 years) on a single site. Six standard scenarios, each representing a different region expected to be vulnerable to groundwater contamination, are available for use with PWC-GW for risk assessment purposes. In PWC-GW simulations, each of these standard scenarios was used. EDWCs for groundwater (**Table B3**) were higher than those estimated for surface water; therefore, groundwater EDWCs are recommended for use in this drinking water assessment.

Table B3. Pesticide Water Calculator-Groundwater (PWC-GW) Estimated Drinking Water Concentrations in µg/L Resulting from the Use of Spiromesifen[1]

Scenario	Peak (µg/L)	Breakthrough Time (days)	Throughputs	Post Breakthrough Average (µg/L)	Simulation Average (µg/L)
Submitted New Uses					
Delmarva Sweet Corn	19.14	6939.16	1.58	14.6	6.42
FL Potato	0.028	9612.15	1.14	0.015	0.014
FL Citrus	30.69	**5730.85**	**1.92**	29.0	18.8
GA Peanut	5.48	8837.66	1.24	4.82	1.64
NC Cotton	11.77	6583.10	1.66	11.0	5.36
WI Corn	50.48	8814.35	1.24	1	14.4
Previously Assessed Uses					

WI Corn	**134.34**	8814.35	1.24	**116.34**	**38.68**

[1] **Bolded** value are the highest EDWC or lowest breakthrough times across all uses.

Appendix C. Environmental Modeling Fate Inputs

Environmental fate inputs for modeling aquatic exposure were determined based on current guidance for aquatic modeling (USEPA, 2009, 2010, 2013, 2014a, 2014b, 2015a, 2015b; USEPA and Health Canada, 2013) and using the fate data summarized in the most recently completed risk assessment (USEPA, 2014, D422793). **Table C1** summarizes inputs for the spiromesifen parent alone used for EEC calculations for ecological risk assessment and **Table C2** summarizes inputs for the spiromesifen total residues of concern used for EDWC calculations for human health risk assessment. For the total residues of concern calculations, an organic carbon partition coefficient (K_{oc}) value of 500 mL/g_{oc} was selected due to the disparity between the K_{oc} of the parent and the degradants of concern (>45,000 versus <10 mL/g_{oc}). The value of 500 is a conservative estimate selected to maximize transport by balancing leaching, transport by erosion and water-body sediment sorption in the PWC model (USEPA 2005).

Initial application dates were selection that were within the scenario crop season, beginning at the earliest post-emergence date, with the minimum retreatment interval between each subsequent application. For crops with multiple crop cycles, the subsequent crop cycles were spaced at equal intervals within the year (every 120- or 90-day intervals for the 3 or 4 crop cycles, respectively). These results are expected to be more conservative than for other uses because the modeled scenarios are parameterized for only one crop season per year. This means that the subsequent crop cycles were modeled to occur during fallow periods, which can lead to higher results than would have been produced for a scenario designed for three crop cycles per year. A batch file was created for the simulated surface water scenarios and is available for updating for future modeling (see attached file).

Table C1: Pesticide Water Calculator (PWC) Inputs for Spiromesifen Parent Modeling[1]

Input Parameter	Value	Source/comment
Organic carbon normalized soil partition coefficient K_{oc} (mL/g_{oc})	69400	Mean value. MRID 45819806, 45819819, 45819821
Aerobic Aquatic metabolism half-life ($t_{½}$ in days)	24.2 at 20°C	90th percentile confidence bound on the mean residue of concern half-life in two soils. MRID 45819803, 45819804
Anaerobic aquatic metabolism half-life ($t_{½}$ in days)	54 at 20°C	MRID 45819802
Aqueous Photolysis half-life ($t_{½}$ in days)	6.1 at 40 °N Latitude	MRID 46059301
Hydrolysis half-life ($t_{½}$ in days)	0	Zeroed out hydrolysis to correct for aquatic metabolism
Aerobic Soil metabolism half-life ($t_{½}$ in days)	36.4 at 20°C?	90th percentile confidence bound on the mean residue of concern half-life in four soils. MRID 45819808, 45819824, 45819825
Decay rate on foliage (day^{-1})	Stable	No foliar data available, assumed stable
Molecular weight (g/mol)	370.5	Product chemistry data. MRID 46059302
Vapor pressure (torr @ 25 °C)	7.5 x 10^{-8}	Product chemistry data. MRID 46059302
Solubility in water (mg/L @ 20°C)	0.130	Product chemistry data. MRID 46059302
Henry's Law Constant (atm-m^3/mol)	1.15 x 10^{-5}	Estimated in PWC
Application method	Above Crop	Proposed Label

Input Parameter	Value	Source/comment
Application Efficiency	0.99 ground 0.95 aerial	Offsite Transport Guidance (USEPA, 2013)
Spray Drift	0.062 0.125 aerial	Offsite Transport Guidance (USEPA, 2013)

[1] Environmental fate inputs for modeling were determined based on current guidance for aquatic modeling (USEPA, 2009, 2010, 2013, 2014a, 2014b, 2015a, 2015b; USEPA and Health Canada, 2013).

Table C2: PWC Inputs for Spiromesifen Total Residues of Concern Modeling[1]

Input Parameter	Value	Source/comment
Organic carbon normalized soil partition coefficient K_{oc} (mL/g_{oc})	500	Conservative assumption based on the residues of concern. MRID 45819806, 45819819, 45819821
Aerobic Aquatic metabolism half-life ($t_{½}$ in days)	2200 at 20 °C	90th percentile confidence bound on the mean residue of concern half-life in two soils. MRID 45819803, 45819804
Anaerobic aquatic metabolism half-life ($t_{½}$ in days)	Stable	MRID 45819802
Aqueous Photolysis half-life ($t_{½}$ in days)	Stable	MRID 46059301
Hydrolysis half-life ($t_{½}$ in days)	Stable at 40 °N Latitude	MRID 45819734
Aerobic Soil metabolism half-life ($t_{½}$ in days)	149 at 20 °C	90th percentile confidence bound on the mean residue of concern half-life in four soils. MRID 45819808, 45819824, 45819825
Decay rate on foliage (day^{-1})	Stable	No foliar data available, assumed stable
Molecular weight (g/mol)	370.5	Product chemistry data. MRID 46059302
Vapor pressure (torr @ 25 ºC)	7.5 x 10^{-8}	Product chemistry data. MRID 46059302
Solubility in water (mg/L @ 20ºC)	0.130	Product chemistry data. MRID 46059302
Henry's Law Constant (atm-m^3/mol)	1.15 x 10^{-5}	Estimated in PWC
Application method	Above Crop	Proposed Label
Application Efficiency	0.99 ground 0.95 aerial	Offsite Transport Guidance (USEPA, 2013)
Spray Drift	0.066 ground 0.135 aerial	Offsite Transport Guidance (USEPA, 2013)

[1] Environmental fate inputs for modeling were determined based on current guidance for aquatic modeling (USEPA, 2009, 2010, 2013, 2014a, 2014b, 2015a, 2015b; USEPA and Health Canada, 2013).

Appendix D. Representative Output from Modeling

CALettuceSTD EDWC simulation for 3 crops per year, aerial application
Variable Volume Water Model, Version 1.02000000000000

****
Performed on: 5/25/2017 at 16:46

Peak 1-in-10.0 = 43.4 ppb
Chronic 1-in-10.0 = 27.4 ppb
Simulation Avg = 21.7 ppb
4-d avg 1-in-10.0 = 42.8 ppb
21-d avg 1-in-10.0 = 41.1 ppb
60-d avg 1-in-10.0 = 35.9 ppb
90-d avg 1-in-10.0 = 33.8 ppb
1-d avg 1-in-10.0 = 43.2 ppb
Benthic Pore Water Peak 1-in-10.0 = 32.0 ppb
Benthic Pore Water 21-d avg 1-in-10.0 = 31.6 ppb
Benthic Conversion Factor = 20.4 -Pore water (ug/L) to (total mass, ug)/(dry sed mass,kg)
Benthic Mass Fraction in Pore Water = 0.182E-01

YEAR	Peak	4-day	21-day	60-day	90-day	Yearly Avg	Benthic Pk	Benthic 21-day
1	2.92E+01	2.86E+01	2.67E+01	1.77E+01	1.27E+01	4.28E+00	1.41E+01	1.22E+01
2	2.82E+01	2.79E+01	2.75E+01	2.61E+01	2.52E+01	2.01E+01	2.32E+01	2.31E+01
3	3.16E+01	3.13E+01	3.03E+01	2.86E+01	2.72E+01	2.25E+01	2.53E+01	2.53E+01
4	3.77E+01	3.73E+01	3.53E+01	3.26E+01	2.73E+01	2.02E+01	2.65E+01	2.60E+01
5	3.79E+01	3.75E+01	3.55E+01	3.23E+01	3.10E+01	2.33E+01	2.69E+01	2.68E+01
6	3.54E+01	3.49E+01	3.32E+01	3.26E+01	3.10E+01	2.35E+01	2.78E+01	2.77E+01
7	3.20E+01	3.17E+01	3.21E+01	3.11E+01	3.06E+01	2.39E+01	2.85E+01	2.85E+01
8	2.28E+01	2.26E+01	2.26E+01	2.23E+01	2.16E+01	1.89E+01	2.14E+01	2.14E+01
9	3.04E+01	3.00E+01	2.93E+01	2.74E+01	2.62E+01	2.15E+01	2.46E+01	2.45E+01
10	3.54E+01	3.49E+01	3.32E+01	2.92E+01	2.76E+01	2.32E+01	2.59E+01	2.55E+01
11	3.32E+01	3.34E+01	3.34E+01	3.26E+01	3.12E+01	2.25E+01	2.80E+01	2.80E+01
12	3.49E+01	3.43E+01	3.24E+01	2.77E+01	2.28E+01	1.72E+01	2.29E+01	2.20E+01
13	2.80E+01	2.76E+01	2.80E+01	2.95E+01	2.83E+01	2.23E+01	2.53E+01	2.52E+01
14	4.97E+01	4.91E+01	4.63E+01	3.52E+01	3.03E+01	2.64E+01	3.21E+01	2.98E+01
15	4.47E+01	4.49E+01	4.46E+01	4.34E+01	4.22E+01	3.18E+01	3.87E+01	3.87E+01
16	3.09E+01	3.06E+01	2.97E+01	2.89E+01	2.78E+01	2.49E+01	2.66E+01	2.66E+01
17	3.65E+01	3.59E+01	2.82E+01	2.67E+01	2.68E+01	2.37E+01	2.67E+01	2.66E+01
18	4.36E+01	4.31E+01	4.13E+01	3.81E+01	3.62E+01	3.21E+01	3.45E+01	3.45E+01
19	3.04E+01	3.02E+01	2.99E+01	3.05E+01	3.04E+01	2.43E+01	3.05E+01	3.07E+01
20	3.24E+01	3.21E+01	3.17E+01	3.02E+01	2.94E+01	2.40E+01	2.79E+01	2.78E+01
21	4.12E+01	4.06E+01	3.90E+01	3.60E+01	3.41E+01	2.75E+01	3.18E+01	3.17E+01
22	2.59E+01	2.56E+01	2.50E+01	2.49E+01	2.47E+01	2.13E+01	2.47E+01	2.48E+01
23	2.88E+01	2.85E+01	2.74E+01	2.57E+01	2.46E+01	2.15E+01	2.44E+01	2.43E+01
24	2.44E+01	2.41E+01	2.26E+01	2.27E+01	2.22E+01	1.71E+01	2.15E+01	2.15E+01
25	2.71E+01	2.67E+01	2.56E+01	2.22E+01	2.09E+01	1.77E+01	2.00E+01	1.96E+01
26	2.87E+01	2.84E+01	2.73E+01	2.57E+01	2.45E+01	2.12E+01	2.38E+01	2.38E+01
27	3.57E+01	3.53E+01	3.35E+01	3.04E+01	2.87E+01	2.42E+01	2.67E+01	2.67E+01
28	2.81E+01	2.78E+01	2.69E+01	2.71E+01	2.68E+01	2.12E+01	2.52E+01	2.52E+01
29	2.54E+01	2.55E+01	2.54E+01	2.35E+01	2.27E+01	1.68E+01	2.11E+01	2.11E+01
30	1.58E+01	1.57E+01	1.54E+01	1.50E+01	1.47E+01	1.21E+01	1.45E+01	1.45E+01

****
****
Effective compartment halflives averaged over simulation duration:

washout halflife (days) = 245.069691209941
water col metab halflife (days) = 3445.63715310967
zero hydrolysis 0
zero photolysis 0
volatile halflife (days) = 1226.53670541716
total water col halflife (days) = 192.826923214592

zero burial 0
zero benthic metab 0
zero benthic hydrolysis 0
zero benthic total degradation 0
****
Fractional Contribution of Transport Processes to Waterbody & Total Mass (kg):

Due to Runoff = 0.7708 96.74
Due to Erosion = 0.0123 1.549
Due to Drift = 0.2169 27.23
****
Flow in/out Characteristics of Waterbody:
Average Daily Runoff Into Waterbody (m3/s) = 4.717956397970431E-003
Baseflow Into Waterbody (m3/s) = 0.000000000000000E+000
Average Daily Flow Out of Waterbody (m3/s) = 4.717956397970287E-003
****
Inputs:
500.0 = oc partitioning coefficient
2200. = water column half Life
20.00 = reference temp for water column degradation
0.000 = benthic Half Life
0.000 = Reference temp for benthic degradation
2.000 = Q ten value
0.000 = photolysis half life
0.000 = reference latitude for photolysis study
0.000 = hydrolysis half life
370.5 = molecular wt
0.7500E-07 = vapor pressure
0.1300 = solubility
0.1728E+07 = field area
0.5260E+05 = water body area
2.740 = initial depth
2.740 = maximum depth
5 1=vvwm, 2=usepa pond, 3 = usepa reservoir, 4 = const vol no flow, 5 = const vol w/flow
F T = burial, else no burial
0.1000E-07 = mass transfer coefficient
0.5000 = PRBEN
0.5000E-01 = benthic compartment depth
0.5000 = benthic porosity
1.350 = benthic bulk density
0.4000E-01 = OC frcation in benthic sediment
5.000 = DOC in benthic compartment
0.6000E-02 = benthic biomass
1.190 = DFAC
30.00 = SS
0.5000E-02 = chlorophyll
0.4000E-01 = OC frcation in water column SS
5.000 = DOC in water column

0.4000 = biomass in water column
FRACTION AREA CROPPED = 1.00000000000000

Appendix E: Modeling Input Batch File.


Aerial Eco Zero Hyd Zero Buffer.xlsx


Ground Eco Zero Hyd Zero Buffer.xlsx